

Advanced Life Support Technologies and Scenarios

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As NASA looks beyond the International Space Station toward long-duration, deep space missions away from Earth, the current practice of supplying consumables and spares will not be practical nor affordable. New approaches are sought for life support and habitation systems that will reduce dependency on Earth and increase mission sustainability. To reduce launch mass, further closure of Environmental Control and Life Support Systems (ECLSS) beyond the current capability of the ISS will be required. Areas of particular interest include achieving higher degrees of recycling within Atmosphere Revitalization, Water Recovery and Waste Management Systems. NASA is currently investigating advanced carbon dioxide reduction processes that surpass the level of oxygen recovery available from the Sabatier Carbon Dioxide Reduction Assembly (CRA) on the ISS. Improving the efficiency of the recovery of water from spacecraft solid and liquid wastes is possible through use of emerging technologies such as the heat melt compactor and brine dewatering systems. Another significant consumable is that of food. Food production systems based on higher plants may not only contribute significantly to the diet, but also contribute to atmosphere revitalization, water purification and waste utilization. Bioreactors may be potentially utilized for wastewater and solid waste management. The level at which bioregenerative technologies are utilized will depend on their comparative requirements for spacecraft resources including mass, power, volume, heat rejection, crew time and reliability. Planetary protection requirements will need to be considered for missions to other solar system bodies.